BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

SUBJECT: Apollo 10 Television
Case 320

DATE: April 7, 1969

FROM: J. T. Raleigh

MEMORANDUM FOR FILE

The Apollo 10 CSM (106) is being equipped to stow two television cameras, one the Block I black and white camera, the other a field sequential color camera. The color camera built by Westinghouse for the Navy and its small on-board black and white monitor weigh about 13 lbs.

The Apollo black and white cameras generate 10 frames per second with 320 lines and are scan converted on Earth to the commercial format of 525 lines, 30 frames per second.

The color camera is a standard commercial format camera to which a rotating color wheel is added to appropriately filter optically the sequential fields. The video waveform is identical to that for standard video signals and can be sent through common carrier TV transmission facilities. Three sequential fields are recorded on a magnetic disc and played back together to generate picture in a standard color format.

The CSM has an FM transmitter that is used for either television or for data dump. LM 4 used for Apollo 10 is not wired for television. When transmitting television, LM tracking by the MSFN is not possible; moreover the Apollo 10 color television implementation on the LM would eliminate voice, telemetry and PLSS data as the color television camera spectrum overlap the subcarriers used for these functions. Based on the MSC test, a usable picture although noisy can be obtained from the CSM High Gain Antenna (HGA) to an 85 ft MSFN station from lunar distances. Obviously, the quality is improved using the Goldstone (GDS) 210 ft antenna. A new microwave link connecting the 210 ft and MSFN 85 ft sites at Goldstone will be installed prior to Apollo 10 and there may be a request to use the 210 ft antenna.

The current plan is to use the color camera and revert to the slow scan black and white if there is difficulty with the color system. At the present time there is no method to use the sequential color as standard black and white. The color wheel cannot be stopped. The coverage might be limited to GDS, but there is a desire to transmit major flight events as they happen. Madrid (MAD) seems to provide the most desirable additional coverage of Apollo 10 activities, although Honeysuckle (HSK) could be available if requested sufficiently prior to the mission.

This color system has been demonstrated several times at MSC. It should be noted that the black and white transmission, while having no technical limitations, does produce a flicker effect when viewed on a conventional TV picture monitor. This flutter is due to the differences in the content of the various colors which are sequentially transmitted. The flutter has been subjectively rated as from noticeable to distracting. In our opinion release of the black and white prior to color conversion would not be desirable.

The subjective evaluation of this particular type of color reconstruction has not been widely tested. Because of the 3 to 1 sequential encoding the field rate can be considered at 20 fields per second as compared with the 10 frames per second used in previous Apollo missions. However, it should be noted that the images for objects in motion will have a different time for each of the three colors resulting in some blurring or color fringes. The vertical resolution should be comparable with the scan-converted black and white.

There will be a demonstration of the system at Houston and a test of the ground system with an aircraft at Goldstone during the last week of April and a CSM 106 demonstration in the plus count of the Dry CDDT.

The public has been informed that NASA is considering flying the color camera, but the nature and limitations including the details of the processing at Houston have not been widely discussed.

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2034-JTR-rkw

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